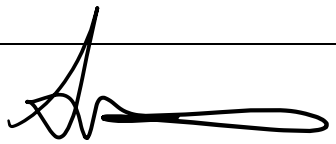
Interim Guidance Note on the Planning and Design of Shared Use Bus Boarders

TfL Engineering

EVERY JOURNEY MATTERS

Prepared for:	Transport for London
By:	TfL Engineering – Highways and Traffic Engineering Team
Address:	3rd Floor Palestra 197 Blackfriars Road London SE1 8NJ

	Name		**Date**
Author	Mark Artis Senior Engineer, Traffic Engineering		December 2021
			December 2021
Reviewer(s)	Ryan Cooper, Principal Engineering Leader, Highways	Rob Cyples, Senior Engineer, Road Safety	December 2021
Approver	Jason Wilton Principal Engineering Leader, Traffic Engineering		February 2022
			February 2022
Board Approval	H&T Technical Authority		March 2022

Version	Description	Date
1.0	Initial DRAFT issue	July 2021
2.0	Final issue	March 2022

1 Introduction

The Mayor's Transport Strategy sets out the ambition to deliver a London-wide strategic cycle network with new, high quality, safe routes and improved infrastructure to tackle barriers to cycling for both shorter and longer trips.

Minimising road danger is fundamental to the creation of streets where everyone feels safe walking, cycling and using public transport. Road danger disproportionately affects people travelling on foot, by cycle or by motorcycle, with 80 per cent of all those killed or seriously injured on London's roads travelling by these modes. Safety concerns are the main reasons people give for not cycling more.

Providing cycle segregation from motor traffic on busy routes is important to encourage more people to take up cycling. Customer feedback shows that people feel more confident cycling in segregated facilities.

Whether to maintain cycle segregation through a bus stop is an important design consideration, with the optimal layout dependent on several factors including motor traffic flows and speeds, the nature of the general provision for cycling on the corridor, bus infrastructure and operation, and the amount of road space available. The maximum separation provided by a Bus Stop Bypass may not always be achievable, with current design guidance offering limited alternative layouts to such a scenario.

An alternative layout that has been devised to provide separation for people cycling from motor traffic past a bus stop, is the Shared Use Bus Boarder (SUBB). This arrangement comprises a cycle facility running between the bus stop cage and the footway and shelter, with bus passengers boarding and alighting onto and across the cycle track.

SUBBs are intended to improve safety for cyclists by avoiding the need for cyclists to pull out into general traffic in order to overtake a stationary bus. Recent monitoring, undertaken by WSP[1] on behalf of TfL, suggests that 80 per cent of people cycling prefer to use a SUBB compared to cycling in the carriageway, with a particularly high level of women and older men preferring the segregated facility. Therefore, there is a

[1] Shared Use Bus Boarders Monitoring Parts 1-3 (WSP, 2019)

case for considering the benefits of these arrangements for diversifying and increasing the uptake of cycling.

There are, however, concerns that have been expressed by accessibility stakeholders and the general public that some SUBB arrangements are awkward to use, as pedestrians are required to cross over a cycle track to board and alight a bus. These concerns should be taken into consideration throughout the design process, with regular local engagement, seeking to identify such issues.

Bus stops are the key access, egress and interchange facilities for the millions of Londoners who access the system. To engender the modal shift to sustainable modes of transport, safe, accessible and attractive bus stops will be vital, to help to maintain the reliability of the bus network.

Over the last 15 years London has invested in an accessible bus network, and bus stops are vital to supporting accessibility. Ensuring that the London bus network continues to be accessible for all Londoners, is critical for London's future economic prosperity and social cohesion.

While monitoring data would suggest that interactions between pedestrians and cyclists at shared use bus boarders are mostly of a low level of severity (where a precautionary action or a controlled action has occurred, as categorised in the WSP monitoring) and happen relatively infrequently, designers should carefully consider the local context, bus service frequency and pedestrian and cycle flows as part of the design discussions – details of which are covered in this guidance note.

This note represents the first formal assessment and design guidance for Shared Use Bus Boarders issued by TfL and is based on the outcome of on-street research, conducted through 2018-20. It is intended that this guidance is used by street designers to assist in determining an appropriate layout for providing suitable cycling infrastructure at bus stops.

It supplements guidance on cyclists at bus stops in the London Cycling Design Standards (LCDS) and the Accessible Bus Stop Design Guidance.

This note also provides some further information on the Bus Boarder (section 6.6.12) mentioned in DfT's Local Transport Note 1/20 "Cycle Infrastructure Design",

published in July 2020. For clarity, TfL will continue to refer to this arrangement as a ‘Shared Use Bus Boarder’, rather than ‘bus stop boarder’ as described in LTN 1/20, to avoid confusion with the conventional bus boarder build-out, Section 7 of Accessible Bus Stop Design Guidance, which does not permit cycling off-carriageway through the bus stop area.

2 Shared Use Bus Boarder definition

Shared use bus boarders (SUBBs) provide an off-carriageway cycle facility between the bus cage and the bus shelter or passenger waiting area. Bus passengers are required to traverse the designated cycle facility to board and alight the bus. This area is typically at least the length of the bus cage and there is, therefore, some potential for bus passengers and cyclists to interact.

The design of the SUBB will follow the design parameters as laid out in TfL's Accessible Bus Stop Design Guidance to ensure that the bus stops are accessible to all, with particular consideration for the needs of passengers with impairments. Accordingly, the planning of a SUBB must consider a range of people which may be impacted by the layout and this is best captured as part of an Equality Impact Assessment (EqIA) and through relevant stakeholder engagement.

3 Assessment Considerations

SUBBs are typically to be considered where there is a need to afford cyclists greater separation past a bus stop but there is insufficient space to provide a Bus Stop Bypass.

Monitoring of existing SUBB layouts in different settings has looked at behaviours of pedestrians and cyclists and sought to quantify how often interactions between the two groups occur. The monitoring showed that the number of user interactions increased when there was a combination of both increasing cycle flows and pedestrian flows. However, it should be noted that overall, the total number of interactions was generally considered to be relatively low, with the vast majority of interactions being of a low level of severity.

As an indicative guide for determining whether to consider the application of a SUBB, the following flow relationships should be considered, while also noting other

pedestrian design considerations related to footway usage and capacity, desire lines and stationary activities.

3.1 Bus Stop Metrics

Part 3 of the Accessible Bus Stop Design Guidance discusses how to determine the capacity of bus stops and should be considered when undertaking a review of whether a SUBB is suitable for a particular location. Incidences of multiple buses arriving at a stop, at the same time, may require a longer bus cage and therefore a longer overall SUBB. With increased number of services at a stop it is likely there are going to be more people boarding and alighting at the stop. The use of stops that have driver changeover points may also result in longer dwell times for buses, so this should be considered as part of how buses use a stop.

3.2 Cycle Flows

Section 4.4 of the LCDS categorises cycle flows and defines a Very Low/Low flow category for a with-flow facility as being below 200 cyclists per hour in the peak. Based on recent monitoring, which shows a trend for increased interactions with pedestrians above this level, it is recommended that this flow category is used as an indicative threshold for assessing the suitability of a SUBB, as shown in **Table 1**.

There may be variations of cycle flow, dependent on the location and context, and it is possible the peak flows for cycles differ in time to that of other users. In addition, where cycle demand is close to the upper limit of the location design threshold, the potential impact of seasonal changes in flow and general growth in active travel should be carefully considered to determine the suitability of a SUBB.

3.3 Pedestrian flows / boarders and alighters

Section 4.5.5 of the LCDS describes a Very Low/Low flow category of pedestrians in partially separated or shared environment as below 200 pedestrians per hour. It is recommended that this figure is used as a threshold when reviewing the suitability of a SUBB, based on the number of boarders and alighters crossing the designated cycle facility.

The routes that pedestrians take to and from the bus stop should be understood to assist with capturing all the relevant flows in the area. For example, a nearby

controlled pedestrian crossing may increase flow from one direction that may mean that some pedestrians do not travel 'through' the area of a bus stop for its full length.

A Pedestrian Comfort Level (PCL) assessment may be of use within the footway area of the SUBB to determine crowding space for users. This assessment should not include the cycle track or the buffer zone as these are not areas that pedestrians are expected to dwell or wait; if these areas are needed for pedestrian use, then the suitability of the SUBB would likely need to be called into question.

For bus stops in London, the number of boarders and alighters is available from TfL – please contact the Project Sponsor for these figures. A 15 per cent figure of the 12-hour (BUSTO) data of boarders and alighters can be used to estimate an indicative peak hour demand. Data from a month with stable ridership of the bus routes should be used (i.e. November 2019, a pre-COVID situation). This number, in addition to the number of people moving in and around the area, should be assessed as per **Table 1**, to determine SUBB suitability.

Table 1 – SUBB cycle flow and bus boarder and alighter flow considerations

	Peak hour boarders and alighters	Peak hour one-way cycle flows	Suitability?
Scenario 1 Low passenger and cycle flows	<200 passengers / hour	<200 cyclists / hour	Yes*
Scenario 2 Moderate passenger flows and low cycle flows	>200 but <450 passengers / hour	<200 cyclists / hour	Yes* - if passenger flow goes into 'High' category (>450 per hour), not suitable
Scenario 3 Low passenger flows and moderate cycle flows	<200 passengers / hour	>200 cyclists / hour	Yes*
Scenario 4 Moderate passenger flows and moderate cycle flows	>200 passengers / hour	>200 cyclists / hour	No**

* Subject to careful consideration of the local context and the width available

**Subject to a review of alternative design options and the case for cycle segregation

4 Design Considerations

Each bus stop location needs to be assessed in its context to provide the optimal layout for a SUBB. This section summarises the infrastructure components that designers should consider in determining the optimal layout for the key components shown in Figure 1. Fundamentally these components should be included in any SUBB layout, but they may vary to some extent as outlined in this guidance, owing to site conditions and local design preference. The key components of a SUBB are:

- The cycle track
- The buffer zone
- The footway
- The passenger waiting area

The key components require tonal differentiation through the use of contrasting materials and / or coloured surface dressings to denote the cycle lane, buffer zone and footway, as detailed in Section 4.4.

4.1 Cycle track

The cycle track should be a maximum of 1.5m wide to encourage single file cycle flow through the bus stop area. A wider track may enable cyclists to overtake one another, which is to be discouraged in a bus passenger boarding and alighting area.

The cycle track may have an absolute minimum width of 1.2m, however it should be noted that in situations where a 1.2m cycle track is proposed, the buffer will form part of the effective width of the cycle track and should be designed so that wider cycles can overrun the buffer strip and therefore kept free of obstruction.

The footway, cycle track and buffer should be flush with one another to facilitate ease of movement across the three areas for bus passengers with mobility impairments.

The use of SUBBs with bi-directional tracks should only be considered where cycle flows are in the Very Low / Low flow category and where pedestrian numbers are also Very Low / Low. It is unlikely there will be many instances where a bi-directional SUBB would be appropriate and feel comfortable for all users. Additional advice should be sought from TfL Engineering prior to developing these layouts.

Where a bi-directional cycle track is present at a SUBB, the width of the cycle track should be provided at a minimum of 2.5m and will require a 1.0m wide buffer next to the cycle track. This wider buffer is recommended alongside bi-directional cycle tracks to assist pedestrians stepping off the bus, as some cyclists passing closer to a bus will be coming from the opposite direction (i.e. from the right).

Additional cycle road markings to TSRGD Diag. 1057 should be considered on the bi-directional track to enhance pedestrian awareness that cyclists will be approaching from the left and right.

4.2 Buffer Zone

The buffer zone is considered essential and must be provided on all new SUBBs. It offers alighting passengers a form of separation when disembarking a bus and provides an offset between cyclists travelling through the SUBB and buses at the adjacent stop.

A buffer zone of between 0.5m and 1.0m should be provided adjacent to the cycle track. The wider the buffer zone, the more likely it is to be used as a pedestrian waiting area, which is not considered a benefit for a SUBB as it can result in pedestrians waiting on the buffer and blocking the cycle track, leading to more interactions.

The buffer zone should tonally contrast to the cycle track, using a materials palette that complements that of the footway.

4.3 Footway

The footway at a SUBB should be sufficiently wide to cater for the number of pedestrians and waiting passengers without requiring these users to enter the cycle track. Street furniture in the vicinity of the SUBB can create pinch points and should be reviewed to maintain required widths and identify the optimal location for bus infrastructure. A Pedestrian Comfort Level (PCL) assessment can assist designers to determine if the footway space is acceptable for the given area, with a ‘comfortable’ PCL being the target.

While it is desirable to provide a minimum 2.0m width footway adjacent to a shared use bus boarder, it is recognised that this facility will usually be considered in constrained locations and so it may be deemed acceptable to provide an absolute

minimum of 1.5m to allow for a wheelchair to pass a pedestrian, as defined by DfT's Inclusive Mobility (2005). The arrangement should provide satisfactory PCL in addition to these minimum widths. The available clear footway width will likely determine the type of bus shelter that can be used. Where a bus shelter is present, an absolute minimum width of 1.0m past the shelter must be maintained. The context and the expected use of the site should also be used to determine the space requirements, for example, frequent activity of people with limited mobility using motorised wheelchairs, or high numbers of people pushing buggies / double buggies near a nursery or school, may require additional footway space above these absolute minima.

4.4 Materials and markings

The surface materials and markings perform key functions in highlighting the change in space from the surrounding footway and carriageway. Each user group needs the area to be a legible as possible, with consistency of materials important so messages are recognisable at all SUBBs.

Pedestrians need to be encouraged to wait on the footway by giving clear definition of the cycle track. It is crucial that a suitable tonal contrast is provided between the cycle track and footway and between the footway and carriageway (*contrast ratio per cent to be determined by TfL Engineering*). A contrast in surfacing colour is preferable to that of material variation based on the same colour (for example, grey). The visual and tonal contrast offered by colour is beneficial to some visually impaired users navigating through the streetscape and is important in making the SUBB operate effectively. To accommodate the needs of people that are unable to detect tonal contrast, the bus stop flag should be provided on the footway so that those people will be able to find the bus stop without interacting with the cycling facility.

Surface materials can be asphalt or paving but there should be consideration for colour application, surface grip and maintenance. The delineating line between the footway and cycle track is best defined as a flush kerb, approximately 100-150mm wide.

The cycle track, footway and buffer must be at the same level, i.e. with no level differential. The kerb adjacent to the carriageway must have at least a 100mm high

carriageway kerb to enable a bus to deploy its ramp safely. Best practice is a kerb height between 125mm and 140mm.

Tramline tactile paving can be used to act as the transition point from the approaching footway into the area where cyclists will be at footway level. This paving should be 800mm in depth and cover the relevant parts of the cycle track at either end of the SUBB. This is intended assist visually impaired users at the extremities of the facility to understand that they are entering a dedicated cycle facility and to avoid doing so.

A passively safe bollard with a TSRGD Diag. 956 sign may also be used between the cycle track and footway, at the commencement of the SUBB. Consideration must be given to the movement of people past the bollard on the footway and providing relevant effective widths for all users.

Cycle logo markings (TSRGD Diag. 1057) are recommended in the cycle track to further raise awareness among users that they should expect to come across cyclists. For a with-flow facility, at least two symbols should be used; one at the start of the facility, at the top of the ramp and the second in the location of the bus doors where passengers are alighting. Typically, this will be at the rear doors of the bus. It may enhance the visibility of the facility, if an additional logo at the front doors of the bus is provided too.

A ‘cycle give way’ marking to TSRGD Diag. 1003B could be considered to encourage considerate cycle behaviours and highlight the area where people may be boarding and alighting buses at the stop, however, this needs consideration by the designer in terms of placement and how the messaging might be interpreted by cyclists. There is currently a lack of SUBB arrangements that feature a give way

marking and so there is insufficient monitoring data to recommend this feature at present.

4.5 Bus stop infrastructure

The Accessible Bus Stop Design Guidance Bus notes that the bus stop flag indicates to passengers where they should wait and serves as a marker to drivers to show where the bus should stop.

This is based on the bus stopping with the rear of the front doors in line with the flag and passengers boarding from the downstream side of the flag. SUBBs layouts need to consider this and locate the bus flag appropriately within the bus cage.

The bus stop flag often contains information regarding services. If no shelter is present, this may be the sole area for information at the stop. Therefore, it is important to consider where people may dwell to read information and plan street furniture locations accordingly.

A bus shelter performs a valuable function in delivering a broader accessible transport network and can make a bus stop a more attractive proposition to use. Shelters in SUBBs need to meet the relevant requirements set out in the Accessible Bus Stop Design Guidance. Generally, shelters will perform best in a SUBB layout at the rear of the footway; increasing effective width alongside the cycle track and maximising footway circulation space. Where constrained, shelters without end panels or narrow panels (0.65m end panels) could be considered. Designers should consider the inter-visibility between pedestrians and cyclists at the bus shelter.

The frequency of buses will likely determine the length of the bus cage. Where a bus cage is of such length for multiple buses serving the stop at the same time, the use of a SUBB should be carefully considered as this may not be the best solution for the given context. Consideration should also be given to bus stop locations where dwell times are expected to be long owing to operational requirements, such as driver changeover points.

In developing proposals for SUBBs there should be engagement with local representatives of London Buses Operations and Bus Operators.

4.6 Cycle facility on approach

The cycle facility on approach should be, at minimum, a mandatory lane to provide a dedicated space for people cycling, and can be separated from the carriageway through methods such as:

- Light segregation (low-level separators that include vertical features)
- Stepped track
- Physical kerbs

With these facilities a ramp will need to be provided on entry and/or exit to the bus stop area as appropriate, and the ramp gradient should not be steeper than 1:12 and ideally 1:20.

The SUBB may run across the front of an existing kerbline when approaching upstream from the carriageway and as such, the SUBB may include a buildout to the existing footway, into the carriageway. When adjusting an existing kerbline, designers must consider surface water flows and propose appropriate drainage infrastructure.

In some locations, the cycle facility on approach may already be at footway (or intermediate) level and there may be some longitudinal deviation on approach. In these scenarios, the designer should determine how to indicate that the SUBB area is different to the cycle facility on the approach and downstream of the bus stop, focussing on the elements of material/colour contrast, tactile paving and bus stop infrastructure.

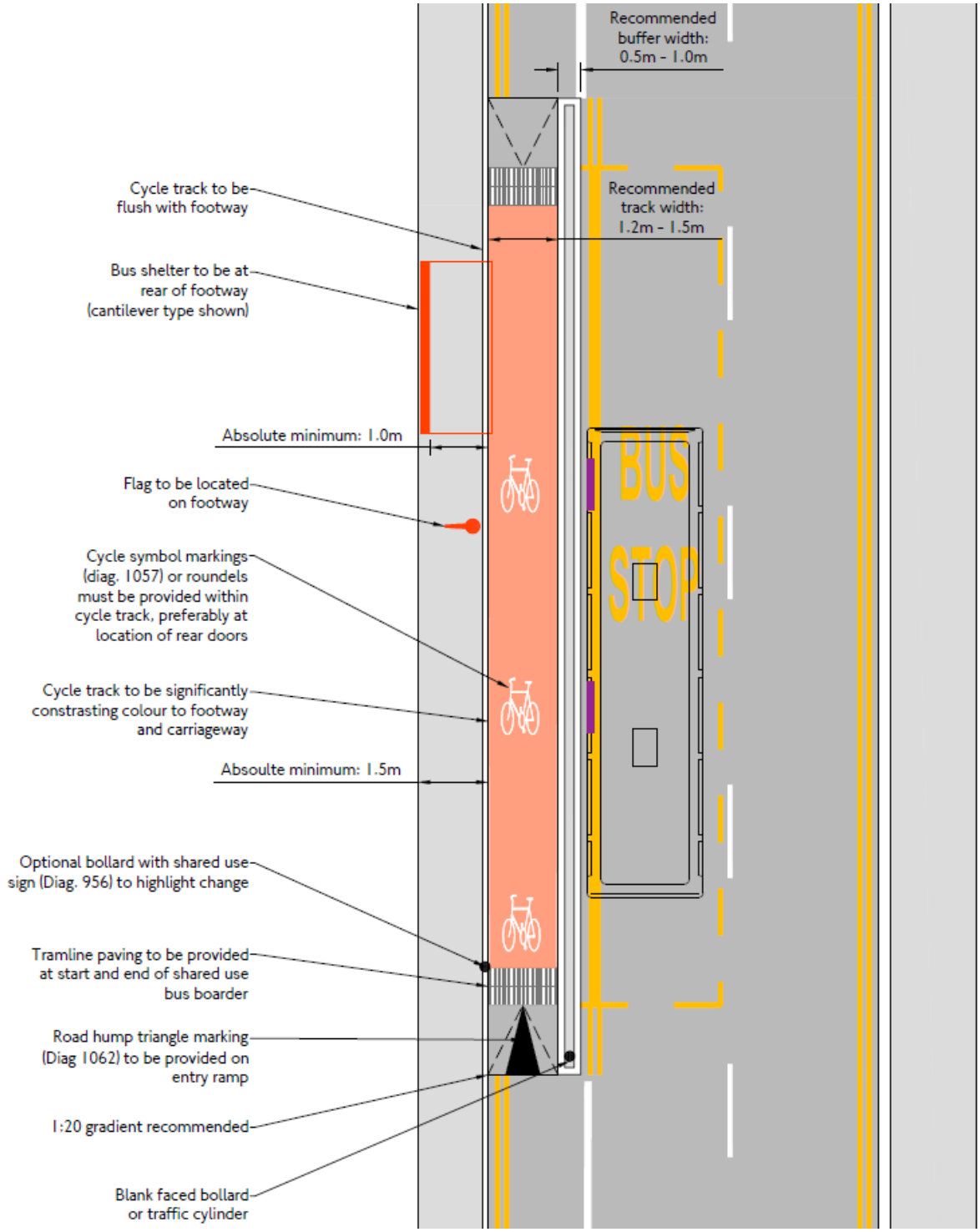


Figure 1 – Recommended components of a with-flow SUBB

5 Next Steps

This interim note is to provide some guidance prior to the completion of further monitoring by Transport for London and participating London boroughs, with the recommended features set out in this guidance being trialled to ensure that they are suitable for different settings. Transport for London will be collating further monitoring from multiple locations with different SUBB layouts and engaging further with accessibility stakeholders to gain the following:

- A more robust understanding of the impacts of SUBBs in order to verify and validate investment decisions i.e. benefits realisation
- How actual user interactions with the infrastructure compare to predicted behaviours
- An understanding of user attitudes and behaviours towards the design of the bus stop area and the cycling scheme as a whole
- The core impacts on mobility and visually impaired user groups, in line with TfL's equality duty as set out in Section 149 of the Equality Act 2010, directly addressing concerns raised by stakeholder groups representing these users

This, in turn, will feed into the development of future schemes, the revision of this interim design guidance and subsequent practitioner training.